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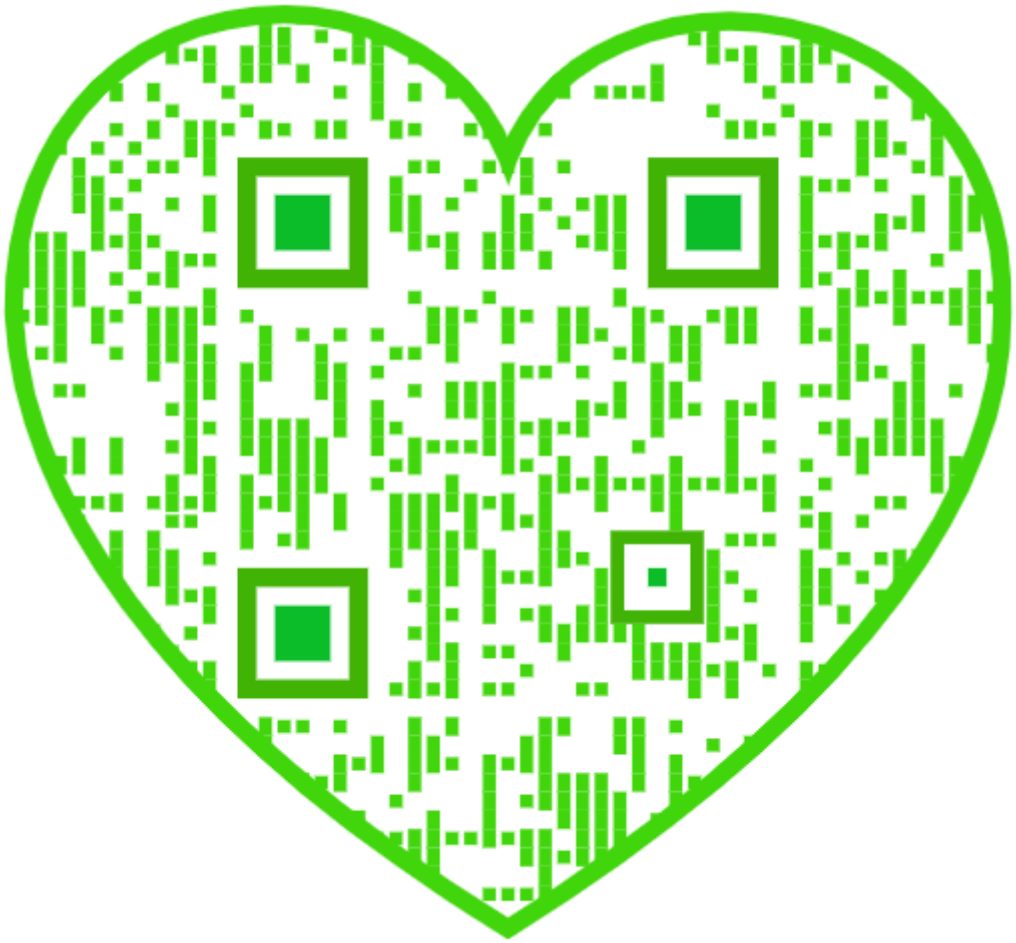

THE ART
of the
BRONZE FOUNDER

Especially in its relation to the
casting of bronze statuary
and other sculptural
work

BY WILLIAM DONALD MITCHELL

The pictures of sculptures shown by lantern slides in this lecture are exclusively of work cast in bronze by the Jno. Williams, Inc. Bronze Foundry

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This lecture in its original form was delivered at Teachers College, Columbia University, February 24th, 1913.

Connecticut State Teachers' Association, High School Building, Hartford, Connecticut, October 24th, 1913.

Connecticut State Teachers' Association, Hillhouse High School, New Haven, Connecticut, October 24th, 1913.

Young Men's Christian Association, Twenty-third Street Branch, New York City, March 11th, 1914.

Revised and printed in 1916.

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Jno. Williams, Inc.
New York

MAY 15 1916

Press of Gibbs & Van Vleck, Inc
New York

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DEDICATED
TO THE MEMORY OF
JOHN WILLIAMS
WHO FOUNDED IN 1875
THE BUSINESS
WHICH NOW BEARS THE NAME
JNO. WILLIAMS, INC.

Important work by the following sculptors has been cast in bronze by the Jno. Williams, Inc. Bronze Foundry. Examples are shown in the lantern slides illustrating the lecture. "The Art of the Bronze Founder."

Adams, Herbert
Aitken, Robert I.
Amateis, Louis
Apel, Marie
Banks, John Lisney
Bitter, Karl
Brenner, Victor D.
Barnhorn, Clement J.
Borglum, Gutzon
Boyle, John J.
Bissell, George E.
Bachman, Max
Butensky, Jules M.
Brines, John Francis
Blaschke, F. R.
Ball, Caroline Peddle
Couper, William
Coppini, Pompeo
Coltman, Ora
Dietsch, C. Percival
Elwell, Frank E.
Ettl, John
Ellerhusen, Ulric H.
Eimer, Elsa
French, Daniel Chester
Fry, Sherry E.
Frishmuth, Harriet
Gudebrod, Louis
Goddard, Ralph
Gruppe, Karl H.
Golde, R. P.
Harvey, Eli
Hering, Henry
Heber, Carl A.
Hyatt, Anne V.
Hartley, J. Scott
Keck, Charles
Kemeys, Edward
Kitson, H. H.
Keyser, Ernest Wise
Kimball, Isabel M.
Knight, Charles R.
Longman, Evelyn B.
Lukeman, Augustus
Lentelli, Leo
Lee, Arthur
Langton, Berenice
MacCarthy, Hamilton
MacNeil, Hermon
McKenzie, R. Tait
Mears, Helen Farnsworth
Morris, Paul Winters
Manship, Paul
Miller, Burr C.
Martiny, Philip
Mitchell, Guernsey
Mayer, L. C.
Miranda, Fernando
Neandross, Sigurd
Newman, Allen G.
Niehaus, Charles Henry
O'Connor, Andrew
Packer, F. H.
Partridge, Wm. Ordway
Perry, R. Hinton
Proctor, A. Phimister
Pratt, George D.
Parsons, Edith Barretto
Quinn, Edmond T.
Rhind, J. Massey
Roth, F. G. R.
Ruckstuhl, F. W.
Ricci, Ulysses A.
Rimmer, Dr. William
Roine, J. E.
Raul, Harry Lewis
Recchia, Richard H.
Salvatore, Victor
Scudder, Janet
Schaaf, Anton
St. Gaudens, Augustus
Sahler, Helen
Underhill, Katharine
Wildenrath, Jenny von
Ward, J. Q. A.
Warner, Olin L.
Weinert, Albert
Weinman, A. A.
Weichsel, John
Wright, Alice Morgan
Wright, F. Harriman
Young, Mahonri
Yandell, Enid
Zolnay, George Julian

In the Art of the Bronze Founder there is a subtle charm for the lover of craftsmanship. The finished product of his skill strongly impresses the thoughtful observer, for the statue or sculptured object in plaster or other material, while the embodiment of the sculptor's genius, lacks something which only the bronze can give—the glow of color and feeling of imperishableness.

The Art of the Bronze Founder

ESPECIALLY IN ITS RELATION TO THE CASTING OF STATUARY AND OTHER SCULPTURAL WORK

By William Donald Mitchell

THE following lecture was prepared at the suggestion of Professor Charles C. Sleffel of Teachers College, Columbia University, and was given first before his classes in Foundry Practice and Metal Craftsmanship.

These students and others from schools in New York and vicinity where Manual Training is given, often visited the Jno. Williams, Inc. foundry to study bronze founding under actual working conditions. It gave me great pleasure to conduct them through the shops and explain the various processes used in producing sculptural and architectural bronze work.

The lecture was made more interesting by the use of lantern slide pictures which showed men at work in the various departments of the Jno. Williams, Inc. establishment and pictures of bronze castings of sculptural work by prominent sculptors.

I regret that in this publication it was not possible to reproduce all the pictures. I hope however in a future edition to be able to show pictures of all the sculptural work which illustrated the lecture.

With this foreword, I shall begin with a very brief reference to the history of bronze founding. Necessarily brief, for the beginning of the art lies away back in that remote period of the earth's history—the days of pre-historic man.

Picture No. 1.

Emblem of Jno. Williams, Inc., Bronze Foundry. (See cover).

Archæologists tell us that the alloy we call "bronze," the combination of the native metals, copper and tin, was known and used extensively many centuries ago—in fact "in the days when the earth was young." Before that time, however, were untold years when primitive man, using the first material at hand possessing strength and durability, had laboriously fashioned the flinty rocks into crude tools and weapons to serve his needs, and this epoch in the history of mankind is termed the "Stone Age."

Then came the discovery of two substances in the earth and that these when melted together formed a material immeasurably superior to stone for the making of implements of war and of the chase. Because of the ease with which this material could be worked, it made possible the manufacture of light articles of a decorative nature and of objects for personal adornment. Thus the discovery of copper and tin—and the resultant alloy "bronze"—enabled primitive man to give expression to an awakening consciousness of an art sense which lifted him above the level of the brute. This was the beginning of the world's civilization—in fact, this discovery marks the very dawn of authentic history. To distinguish these years of progress, due to the discovery and use of bronze, from the preceding years of the "Stone Age", historians have termed the second epoch the "Age of Bronze."

It is an interesting fact that there does not seem to have been any intervening period of time between the "Stone Age" and the "Age of Bronze" when copper was used alone. Apparently primitive man leaped at one stride from the manufacture of stone implements to the

manufacture of articles composed of bronze—a combination of copper and tin. These barbarians apparently knew from the first that a mixture of 90 per cent. copper and 10 per cent. tin gave the best results in castings for an analysis of the metal in relics of the "Bronze Age" that have been found at the bottom of Swiss lakes and buried deep in the caverns of Europe invariably shows that these pieces of bronze are composed of approximately 90 per cent. copper and 10 per cent. tin. Bronze founders throughout the ages have used practically these same proportions for ornamental bronzes. However, since the discovery of zinc, it was found that this metal added to the mixture improved the alloy. Therefore a bronze composed of copper, zinc and tin has become recognized as the standard for bronze statuary and ornamental work.*

Picture No. 2.

Primitive Man Engaged in Bronze Founding.

In Picture No. 2 are shown barbarians in the "Age of Bronze" engaged in the casting of bronze. This is a reproduction of a picture in Ridpath's "History of Mankind." Such a scene as this could easily be imagined by the artist after a study of the subject and observation of relics such as fragments of clay moulds and bronze casts, relics of the "bronze age," which may be seen in our museums.

I should like to say right here that while the bronze founder of to-day has attained a very high degree of skill and produces perfect workmanship in bronze, he has not been helped by any modern inventions. This work is practically all hand-work and the processes by which it is produced are almost identical with those employed at the beginning of the historical era. Science has

*See Page 21.

had no effect on the art of statuary bronze founding. Our ways and methods in the working of bronze do not differ greatly from the ways of the earliest known worker in bronze and iron, "Tubal-Cain," spoken of in the fourth chapter of Genesis as "an instructor of every artificer in brass and iron." When the Bible speaks of "brass" and it is mentioned many times, it is generally agreed that bronze is the metal meant.

But I shall go no further into the history of bronze and its relation to the progress of civilization of the nations of the earth. This has all been set forth in the "Encyclopædia Brittanica" and other reference works and you can get full information on this subject by referring to these authorities.

Prior to the year 1847 no bronze statue had been cast in this country. In that year a portrait statue of Dr. Bowditch by the sculptor, Ball Hughes, was cast, but the work was so crude that the family had the statue recast in Paris—as is evidenced by the inscription on the existing statue "Executed by Ball Hughes, Recast by Gruet, Jne. Fondeur, Paris, 1886."

To the problems of our early sculptors were added the vexatious question of getting their work translated into bronze. As no professional founders had come to this country at that time from the statuary foundries of Europe, they were perforce compelled to try to cast the work themselves, a formidable task for anyone not trained in the art of bronze founding.

In the year 1846 Henry Kirke Brown modeled a group "Indian and Panther" which he himself shortly afterward cast in bronze. Lorado Taft in his History of American Sculpture speaking of American Sculpture of

about this period says: "The practical work of bronze casting should not be passed over lightly. Up to this point we have had no mention of artistic founding except the production of Ball Hughes's 'Dr. Bowditch'—the first bronze statue created in this country, which was perhaps actually antedated by the smaller 'Indian and Panther'. That Mr. Brown installed a miniature foundry in his studio and successfully carried into the ultimate metal many small works speaks volumes for his courage and his ingenuity."

These were the beginnings of the art of statuary bronze founding in this country and though a number of important works were sent abroad to the cities of Paris and Munich to be cast in bronze, it was soon demonstrated that here, where the finest copper in the world was to be had in unlimited quantities from the mines on the shores of our great Lake Superior, castings equal to those made abroad could be produced. The man first to prove this was the sculptor, Clark Mills. He modeled the first equestrian statue erected in the United States. This is the statue of General Andrew Jackson which stands in the public square opposite the White House. When the model was completed he undertook to cast this colossal equestrian statue in bronze. A rough foundry was constructed near Washington and after various disheartening circumstances, the breaking of cranes, the bursting of furnaces, after six failures in the body of the horse, he finally triumphed and produced a perfect bronze cast. On January eighth, 1853, the statue was dedicated.

Another colossal statue cast by Clark Mills was Thomas Crawford's statue of "Freedom" which surmounts the dome of the Capitol at Washington. The casting of this statue was begun in 1860. It was completed and dedicated in 1863. In passing, permit me to pay tribute to the

first American bronze founder by quoting this extract from the "History of American Sculpture."

> "And let us not forget that this home-made sculptor not only designed and modeled those enormous creatures, (equestrian statues) but actually built his own foundry and moulded and cast the statues himself. To one who knows the difficulties of bronze casting, this seems incredible. Verily, there were giants in those days. Whatever we may think of Clark Mills the sculptor, we owe a debt of gratitude to Clark Mills the first professional founder of statuary."

Picture No. 3.

Portrait bust of J. Q. A. Ward, by Charles H. Niehaus, Sculptor. Cast by Jno. Williams, Inc.

A bronze copy of this bust is in the rooms of the National Sculpture Society, New York City.

Picture No. 4.

Bronze Group "Indian Hunter," by J. Q. A. Ward, Sculptor.

This celebrated group "The Indian Hunter" was modeled by J. Q. A. Ward in 1864. A copy in bronze cast by Jno. Williams, Inc., was unveiled in Urbana, Ohio, June 29th, 1914. I quote from the *Monumental News* of May 1914:

> "Mrs. John Quincy Adams Ward, the widow of the distinguished sculptor, has presented to his native city, Urbana, Ohio, a replica in bronze of his first statue, the "Indian Hunter" which is to be unveiled with due ceremony June

29th, the eighty-fourth anniversary of his birth, in Oakdale Cemetery.

The original figure of the "Hunter" is in Central Park, New York, one of the first statues erected there and there is a replica at Cooperstown, New York. Like the latter the Urbana statue will be mounted upon a huge boulder.

The first cast in plaster is in the Corcoran Gallery in Washington, D. C., and will be used by the bronze founders, Jno. Williams, Inc., to whom the commission was given for casting the statue."

Picture No. 5.

Bronze statue of "Henry Ward Beecher." By J. Q. A. Ward, Sculptor.

A bronze copy of the "Henry Ward Beecher" statue by J. Q. A. Ward which stands in front of Borough Hall, Borough of Brooklyn, New York, was cast in 1914 by Jno. Williams, Inc. Bronze Foundry and erected in the grounds of Amherst College.

The United States Government gave a great impetus to the advance of sculptural art when it ordered sculptured bronze doors for the National Capitol. The sculptors chosen to do this work were Thomas Crawford and Randolph Rogers.

Lorado Taft in his "History of American Sculpture" says of these doors, "Few American sculptures have had greater fame than these doors. Admired from the beginning, they had the advantage of narrative form and abundant detail and their renown has gained momentum with the years." The Rogers' doors were finished first. He modeled them in Rome, Italy and they were cast in 1861 in Munich, Germany. The Crawford doors, which

I believe were cast in this country, were not hung until 1868. The third and last pair of bronze doors for the Main entrance to the Capitol at Washington, shown in picture No. 6, were ordered by the Government only a few years ago. The order was given to Louis Amateis, a sculptor who lived in Washington. These doors were cast in 1910. Thus after a lapse of over forty years, all three entrances to the Capitol are provided with sculptured bronze doors.

Picture No. 6.

Bronze Doors, Western Entrance of the Capitol. By Louis Amateis, Sculptor.

I have spoken briefly of the beginnings of the art of bronze founding in this country—the reproduction of sculptors' models by the art of bronze casting. I believe that the pictures of sculpture which were used to illustrate this lecture show clearly the wonderful progress made by the sculptors of this country in the short span of one lifetime. I am proud to be able to show you these pieces of sculpture, the work of American artists, for they are admittedly equal to the best that has been done in foreign countries—where the sculptors have a rich inheritance of art objects and an inborn love of art which has come down to them through countless generations of artists.

The first great stimulus to American Sculptural Art was given by the Centennial Exhibition at Philadelphia in 1876. This caused an awakening to the fact that we were, at that time, so far as sculpture was concerned—"in swaddling clothes." But statues of the greatest sculptural merit were beginning to appear. Certainly this country had had a glorious history and there were many subjects waiting for the hand of the sculptor. One of the first of the great statues produced was "The Minute Man of Concord."

Picture No. 7.

"The Minute Man of Concord." By Daniel Chester French, Sculptor.

The statue, "The Minute Man of Concord" was erected in Concord, Massachusetts and dedicated April 19th, 1875. It was modeled by Daniel Chester French, who was then only twenty-three years of age and just on the threshold of his career. Many copies of the "Minute Man of Concord" in statuette form have been cast in bronze by Jno. Williams, Inc.

Picture No. 8.

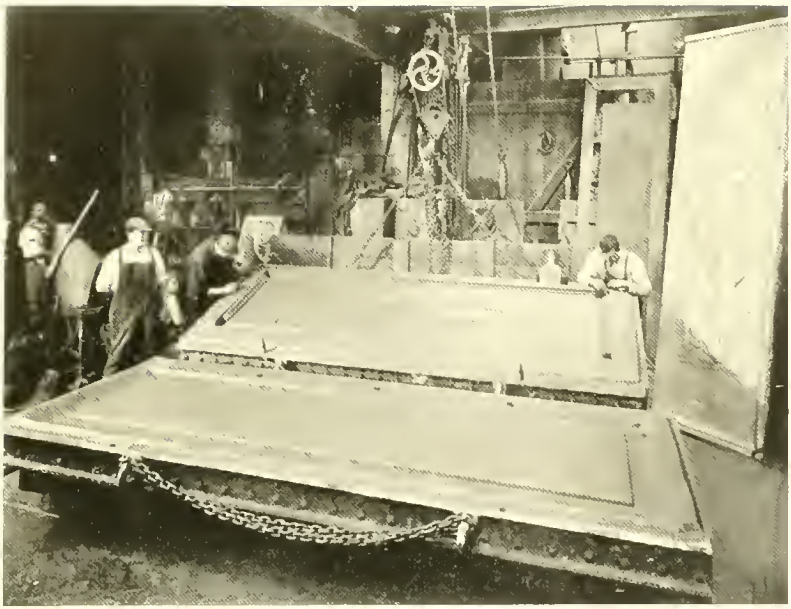
A View in the Jno. Williams, Inc. Bronze Foundry.

Since the days of the bronze founders in the "Age of Bronze" thousands of years have elapsed, yet to-day you can see men in bronze foundries using the same methods and practically the same alloy as were used by the barbarians of the "Bronze Age" shown in a previous picture.

Perhaps it will interest you to know that the Jno. Williams, Inc. Bronze Foundry was started in 1875 by John Williams under whose name the business was carried on until incorporated in 1905. Most of the time there are employed five hundred bronze-workers and foundrymen. People visiting this establishment for the first time express astonishment that a foundry producing colossal bronze statuary exists practically in the heart of New York City. But it was far from the heart of the city forty years ago and the time is rapidly approaching when this and all other similar businesses will have to remove to the suburbs owing to the tremendous increase in land values in New York.

In Picture No. 8 is shown a large mould in which will be cast one "valve" or "leaf" of the sculptured doors for the Boston Public Library. (A picture of the finished bronze doors will shortly be shown). This mould though a very large one is what is called a "simple two-piece mould." The modeling on the door being in low relief, without "undercutting" permits the mould to be made in two parts. The impress of the back of the door is in the sand in one of these parts and the impress of the modeled face of the door is in the other part. You can see the matrix of the modeled face of the door in the sand. The plaster model of the door from which the imprint in the sand has been gotten is standing against the wall. The large iron frames which surround and hold the sand are called "flasks."

The sand used for statuary bronze moulding comes from a sand-pit which is situated in a little village on the outskirts of the City of Paris in France. For that reason it is called "French Sand." Though called "sand" by the foundryman, as a matter of fact it closely resembles a mixture of sand and clay. It can be used just as it comes from the sand-pit although of course it must be finely sieved. No other sand like this has ever been found in the world. You may be sure that many people have looked all over the world for similar sand, for as new sand must be continually used in the moulds, a very great deal is used and if another sand-pit could be found it would be a little "gold mine" for the owner. This sand because of its peculiar properties makes it possible to obtain a mould that will reproduce with marvelous fidelity, the finest lines and markings that appear on the sculptor's model.



Picture No. 8

View in Jno. Williams, Inc., Bronze Foundry.

Showing preparation of mould in which will be cast one valve of the door for the central portal of the Boston Public Library.

Picture No. 9

View in the Jno. Williams, Inc., Bronze Foundry.

Showing the pouring of a large mould. This bronze cast will form one of the bronze doors of the Boston Public Library.

Picture No. 9.

View in Foundry. Pouring Molten Bronze into a Large Mould.

The pouring of a large mould is shown in Picture No. 9. This cast will form one of the bronze doors of the Boston Public Library.

The iron frames, forming the "flask" have been bolted together, holding the sand-mould firmly in place ready for the molten metal to be poured therein. If the casting is a large one a great many pounds of molten metal must be poured all at one time. It is not possible to fill the mould by pouring the contents of the crucibles one at a time into the mould. But the difficulty is gotten over in a very simple manner. You will observe on top of the mould a sort of basin. This basin is made of iron frames lined with moulding sand and fire-clay. It is large enough to hold all the bronze required to cast the statue or whatever cast is to be made. The basin is placed directly over the feeding channel of the mould. Into a hole in the bottom of the basin a plug made of iron covered with sand and fire-clay has been fitted. The end of the plug extends beyond the top of the basin. When the crucibles are emptied one after the other into the basin, this forms a seething lake of molten bronze. The foundrymen then grasp the end of the plug and pull it out and the liquid bronze rushes through the feeding channels which lead to all parts of the mould, filling all parts of it at practically the same instant. All surplus metal, like water seeking its level, ascends vertical channels, called "risers" which have been cut in the sand for that purpose and when this surplus metal appears at the top of these channels, it is a sign that every part of the mould has been filled and that it is likely the cast is a perfect one, but of this no man can tell until all of the sand which envelops the cast has been removed. After the mould has cooled, the cast is

dug out of the burnt sand and the metal which filled the feeding channels is cut away from the cast. The cast is then placed in an acid bath which removes all adhering sand and fire-discolorations. It is then ready for the various processes which I will soon describe.

The molten bronze when poured into the moulds gives off a great quantity of dense fumes and richly colored vapors and these with the glow and the glare from the streams of molten metal make a beautiful picture especially on a dark day when the shadowy forms of the workmen can be seen but dimly through the smoke-laden air.

Picture No. 10.

Bronze Doors in the Boston Public Library. By Daniel Chester French, Sculptor.

One of the three sets of bronze doors in the Main Entrance of the Boston Public Library is shown in Picture No. 10. These doors were a notable addition to the sculptural art of this country. They are the work of one of the foremost of our American sculptors, Daniel Chester French. Mr. French's work on the models for these doors extended over a period of twelve years. It was not until the models of all three were completed that he permitted the Jno. Williams, Inc. foundry to go ahead with the casting of the doors in bronze.

Each door is composed of two valves or "leaves" as they are often called. When the two valves swing together, they form apparently one large panel. This is an unique feature in double doors such as these, for double doors usually have a meeting bar in the center called a "stile" in architectural terms. These bronze doors are swung on pivots, hinges would not carry their great weight. They are hung so skillfully that despite the fact that each "valve" weighs one thousand, four hundred pounds, the pressure of a hand is sufficient to swing them to and fro.

Picture No. 11.

Bronze Doors of Congressional Library, Washington, D. C. by Olin L. Warner, Sculptor. Erected December, 1896.

Picture No. 12.

Bronze Doors of Congressional Library, Washington, D. C. by Herbert Adams, Sculptor. Erected January, 1898.

Two of the three sets of bronze doors for the Main Entrance of the Congressional Library at Washington were ordered by the United States Government from the sculptor Olin L. Warner. He lived to complete the first door only "Tradition" and the second door "Written History" was modeled by Herbert Adams.

The Jno. Williams Inc. Bronze Foundry was selected by the United States Government to cast these doors. In the contract the Government specified that the alloy to be used should consist of 90 parts copper, 7 parts zinc and 3 parts tin. Thereafter the Jno. Williams, Inc. Foundry adopted this as a standard alloy for seulptural castings terming it in their specifications for sculptural castings, "statuary bronze of standard fixed by the United States Government."

The third sculptured bronze door for the Congressional Library was the work of Frederick MacMonnies. It was cast in Paris. I am glad to say that experts pronounced the bronze casting and workmanship in the American doors greatly superior to that of the doors cast in France.

Picture No. 13.

View in Foundry of Jno. Williams, Inc. Showing Foundrymen Lifting Crucibles from the Furnaces.

The crucibles full of molten bronze are lifted from the furnaces by means of large tongs. The small crucibles which hold about one hundred pounds each are lifted by "man-power" in the old-fashioned way. The larger crucibles, shown in the picture, each hold four hundred pounds and these are lifted by compressed air power or by chain blocks. These crucibles are made mainly of graphite, sometimes called "plumbago" and again "black lead." The life of a crucible averages about twenty meltings.

Picture No. 14.

Another View in Foundry Showing Men Lifting Crucibles from the Melting Furnaces.

Picture No. 15.

Pouring Metal in Small Moulds.

The pouring of molten metal in small moulds is shown in Picture No. 15. The crucibles are carried from the melting furnaces in iron holders. The man with the iron bar is skimming off the dross which rises to the top of the molten metal. He notes the degree of fluidity of the metal by the color. If a dull red, the metal is too cold and sluggish to pour. If a white heat, then it is too "thin", too "fluid" and either extreme would result in a bad casting. The foundrymen must know when the metal is exactly "right" for pouring. Their good judgment and skill in these matters is simply the result of long practice which trains the eye and the hand,—and mistakes are seldom made.

Picture No. 16.

Bronze portrait bust of "Gordon Taylor" by Marie Apel, Sculptor.

Picture No. 13

View in foundry of Jno. Williams, Inc.

Showing Foundrymen lifting Crucibles from the furnaces.

Picture No. 14

View in foundry of Jno. Williams, Inc.

Showing men lifting Crucibles from the furnaces.

Picture No. 15

View in foundry of Jno. Williams, Inc.

Showing foundrymen pouring
bronze in small moulds.

Picture No. 17

Bronze Portrait Bust of Robert Fulton.
By Jean Antoine Houdon, Sculptor.

Reproduced in bronze
by Jno. Williams, Inc., Bronze Foundry
from original cast owned by the
National Academy of Design.

Picture No. 17.

Bronze Portrait Bust of "Robert Fulton." By Jean Antoine Houdon, Sculptor.

The bust of Robert Fulton, shown in Picture No. 17, was modeled from life by the great French sculptor, Jean Antoine Houdon. The original cast is owned by the National Academy of Design.

Duplicates in bronze were ordered from Jno. Williams, Inc. for the Metropolitan Museum of Art.

National Academy of Design,

New York Historical Society
(Presented by the Colonial Dames of America)

College of the City of New York.

New York University
(Unveiled in Hall of Fame. University Heights, Sept. 29, 1909)

American Numismatic Society,

Geographical Society,

and the Hudson River Day Line Company for the Steamboat, "Robert Fulton."

I will now describe how bronze statuary is cast. This is a much more complicated process than casting flat relief work for in statuary the contours of the surfaces are irregular, forming undercuts. Undercuts are the deep parts in the modeling with overhanging projections. I call your attention to the undercuts in the bust of "Fulton", (Picture No. 17) under the collar, in the cravat, in the eyes, etc., etc. Therefore in statuary moulding as we cannot lift the model from the sand, which we do in plain moulding, we must lift the sand from the model and this is accomplished by packing the sand around the model in small separate "blocks" or sections. These sand blocks are called "cores" hence a statuary bronze moulder is called a "core moulder." The method is illustrated in the charts on the next two pages.

CHART No. 1.

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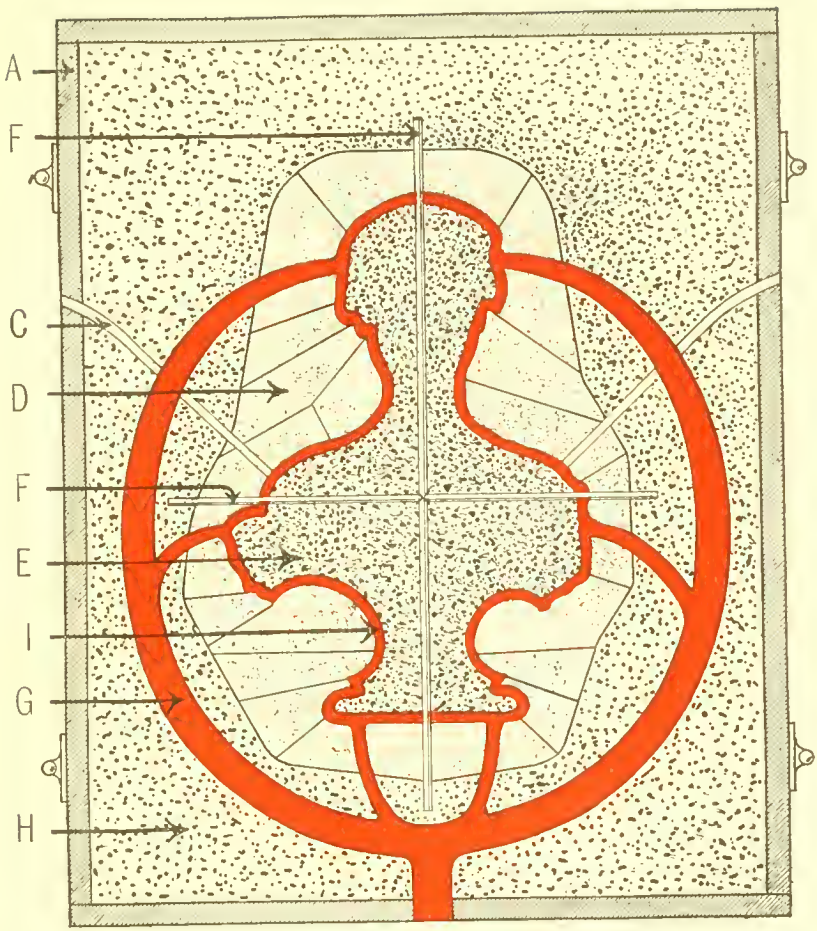
"A"— Iron frames called "flasks."

"B"— Sculptor's plaster model of a portrait bust.

"D"— Separate blocks of moulding sand called "cores." They have been packed one by one around the model.

"H"— Outer sand backing or outer envelope of the mould.

CHART No. 2.



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"A"—Iron frames called "flasks."
"C"—Vents in mould for the escape of gases generated by contact of molten metal with the sand.
"D"—Separate blocks of moulding sand called "cores." They have been packed one by one around the model.
"E"—Inner sand core.
"F"—Iron bars which support the inner sand core "E."
"G"—Feeding channels through which the molten metal is carried to all parts of the mould (shown in red).
"H"—Outer sand backing or outer envelope of the mould.
"I"—Space between inner sand core and the mould when filled with molten bronze (shown in red) forms the bronze cast.

Picture No. 18.

Charts Nos. 1 and 2. Showing Method of Making Sand Moulds for Casting Bronze Statuary.

(See Pages Nos. 24 and 25).

The plaster model "B" in Chart No. 1 is a portrait bust. It will be completely surrounded by separate blocks of sand called "cores", ("D" on Charts Nos. 1 and 2). A description of the charts follows:

"A" shown in Charts Nos. 1 and 2 are the iron frames called "flasks."

"B" shown in Chart No. 1 is the sculptor's plaster model.

"C" shown in Chart No. 2 are the vents in the mould for the escape of gases generated by contact of molten metal with the sand.

"D" shown in Charts 1 and 2 are the separate blocks of moulding sand called "cores." They have been packed one by one around the model.

Then they are removed from the model in the reverse order in which they were made. Then dried in an oven and re-assembled. But of course the plaster model has been removed from the mould. We now have a complete matrix in which the inner sand "core" is supported by iron bars (See "F" Chart No. 2).

The inner sand core ("E" in Chart No. 2) is suspended in the mould by the iron bars "F." The space between the inner sand core and the mould when filled with molten bronze (shown in red—see "I" in Chart No. 2) forms the bronze cast. The bronze cast now surrounds the inner sand core which is afterward dug out—and by this method a hollow bronze cast is obtained.

The feeding channels through which the molten metal is carried to all parts of the mould are also shown in red (See "G" in Chart No. 2).

"H" shown in Charts 1 and 2 indicates the outer backing or outer envelope of the mould. This is composed of a cheaper, coarser sand than the French sand used for the cores.

It is not commonly known that statues, busts, etc. are always cast hollow. Some people think that a bust or statue is solid (like a marble statue). As a matter of fact, a successful bronze cast of a sculptured model could not be made unless the metal was kept to a thickness of from one-quarter of an inch to three-eighths of an inch. You can readily understand that a thin shell of metal will cool and set immediately it fills the mould. An excessive thickness of metal neither makes the casting stronger nor adds to its durability. If there was too great a thickness of metal it would not harden or set for a considerable time and in the slow cooling, would set up strains and shrinkages which would disturb the surfaces of the mould to such an extent that a great deal of the fine detail of the model would be lost and the cast would be worthless.

Picture No. 19.

Bronze Bust of "Dr. William T. C. Morton" by Helen Farnsworth Mears, Sculptor.

Picture No. 20.

Bronze Statue of "Abraham Lincoln" by Daniel Chester French, Sculptor. Erected on monument in Lincoln, Nebraska.

Picture No. 21.

Bronze Statue of "Alma Mater" by Daniel Chester French, Sculptor. Erected in front of Columbia University Library, New York City.

Picture No. 22.

Bronze Statue of "Wendell Phillips" by Daniel Chester French, Sculptor. Erected in Boston, Mass.

Picture No. 23.

Bronze Group, "Lioness and Cubs" by Edward Kemeys, Sculptor.

Picture No. 24.

Bronze Statue, "Scraper" by Charles Henry Niehaus, Sculptor. Placed in the Metropolitan Museum of Art, New York City.

Picture No. 25.

Bronze Statue "Commodore Perry" by Charles H. Niehaus, Sculptor, Erected on "Perry" Monument in Buffalo, New York.

Picture No. 26.

Bronze Statue on Straus Memorial Fountain by Augustus Lukeman, Sculptor. Erected in Straus Park, Broadway and 106th Street, New York City.

Picture No. 27.

Bronze Group on Monument to "Women of the Confederacy" by Augustus Lukeman, Sculptor. Erected in Raleigh, N. C. June 1914.

Picture No. 28.

Bronze Equestrian Statue, "Kit Carson" by Augustus Lukeman and F. G. R. Roth, Sculptors. Erected in Trinidad, Colorado.

Picture No. 29.

Bronze Equestrian Statue "General Franz Sigel" by Karl Bitter, Sculptor. Erected on Riverside Drive and 116th Street, New York.

Picture No. 30.

Bronze Equestrian Statue, "Terry Ranger" by Pompeo Coppini, Sculptor. Erected in Austin, Texas.

Picture No. 31.

Bronze Equestrian Statue, "General Phil Sheridan" by J. Q. A. Ward, Sculptor. Erected in Albany, New York.

Picture No. 32.

Bronze Statue "Carl Schurz" by Karl Bitter, Sculptor. Erected at Morningside Drive and 116th Street, New York City.

Picture No. 33.

Bronze Statue, "Andrew D. White" by Karl Bitter, Sculptor. Erected at Cornell University, Ithaca, N. Y.

Picture No. 34.

Bronze Doors, New Library Building, Wellesley College, Wellesley, Mass. By Evelyn B. Longman, Sculptor.

Picture No. 35.

Bronze Statue "A. J. Cassatt" by A. A. Weinman, Sculptor. Erected in Pennsylvania Railroad Station, New York.

Picture No. 36.

Bronze Statue, "Chief Justice Ruffin" by F. H. Packer, Sculptor. Erected in Loggia of Entrance of the New Supreme Court Building in Raleigh, N. C.

Picture No. 37.

Bronze Statue, "General Ord" by Anton Schaaf, Sculptor. Erected in Vicksburg National Military Park, Vicksburg, Mississippi.

Picture No. 38.

Bronze Statue "Victory" by Robert I. Aitken, Sculptor.

The colossal statue of "Victory" by Robert I. Aitken, Sculptor, surmounts the Manila Battle Monument in Union Square, San Francisco. It measures 14 feet high and weighs over 3,000 pounds.

Picture No. 39.

Colossal Bronze Statue of Samuel de Champlain. By Hamilton MacCarthy, Sculptor.

The statue of Samuel de Champlain shown in Picture No. 39 was erected in Ottawa, Canada. It measures nearly thirteen feet in height and weighs over 3,000 pounds.

Picture No. 40.

Bronze Relief Panel, "Leander Howard Crall" Memorial. By Paul Winters Morris, Sculptor.

Picture No. 40 shows a large bronze panel, the subject of which is the Baptism of Christ. This is part of a memorial, by Paul Winters Morris, erected in Holy Trinity Church, New York City in memory of Leander Howard Crall. The memorial, complete, consists of a marble platform and baptismal font and the bronze bas-relief panel. The bronze panel measures fourteen feet high by six feet eight inches wide and weighs 2,550 pounds. It was cast in one piece by Jno. Williams, Inc. Bronze Foundry, New York.

Picture No. 41.

Bronze Portrait Bas-relief "Dr. Robert Collyer." By Henry Hering, Sculptor. Erected in the Church of the Messiah, New York City.

Picture No. 42.

Allen G. Newman's Colossal Sculpture Entitled, "The Triumph of Peace."

This monument was erected in Atlanta, Georgia, by the Gate City Guard of Atlanta. It commemorates the ending of the war between the North and the South.

Picture No. 43.

Bronze Group on Monument, "Women of the Confederacy" by Allen G. Newman, Sculptor. Erected in Jacksonville, Florida.

Picture No. 44.

Bronze Grille Entrance Doors, Richard M. Hunt, Architect.

Large cast bronze grille entrance doors for a residence in Newport, Rhode Island, are shown in Picture 44. The doors measure 22 feet wide and 14 feet high. They were designed by Richard M. Hunt, one of our great American architects. These doors were made by the Jno. Williams foundry in 1892, at a cost of $50,000.00. When they were erected, newspaper articles were published severely criticising the spending of so great an amount of money—"merely for the front doors of a luxurious dwelling." But this was very foolish criticism for of this $50,000.00 at least $45,000.00 went into the pockets of artists and artisans. I believe it is a most commendable thing that people of great wealth should by the lavish expenditure of money encourage the production of works of art and craftsmanship and thus give to the American artist and artisan the opportunity to show that they have in them the ability to produce work equal to the great examples of Greek, Roman and Florentine art.

I will now describe briefly and as nearly as possible in their proper order the various departments of the Jno. Williams, Inc. Establishment:

I will mention the "Draughting Department" first for to start the architectural bronze work, the very first requirements are full-size working drawings. The patterns which are required for this work are made in the "Wood Pattern Department." There is also a department where plain plaster patterns are made. If however the patterns are required to be ornamented with architectural ornament, this work is done best by modelers of architectural ornament who have their own shops.

Picture No. 45.

View in Foundry of Jno. Williams, Inc., Showing Pattern Makers at Work.

This picture shows men making wood patterns for inscription tablets and architectural bronze work.

Picture No. 46.

View in the Foundry Showing Men at Work on Large Moulds.

The moulds shown in Picture No. 46 are for large castings of ornamental design for architectural work. Note the overhead traveling crane for lifting and carrying moulds from one end of the foundry to the other. I must admit that our ancestors, the foundrymen of the "Bronze Age" had to get along without the aid of this powerful mechanical device.

Picture No. 47.

View in Foundry Showing Men Engaged on Moulds for Large Grilles.

Picture No. 45
View in foundry of Jno. Williams, Inc.
Showing Pattern Makers at work.

Picture No. 46
View in foundry of Jno. Williams, Inc.
Showing men at work on large moulds.

Picture No. 47

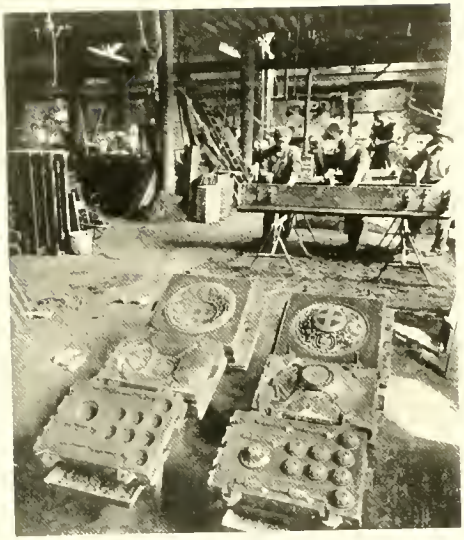
View in foundry of Jno. Williams, Inc.

Showing men at work on moulds for large grilles.

Picture No. 48

View in foundry of Jno. Williams, Inc.

Showing men at work on small plain moulds.



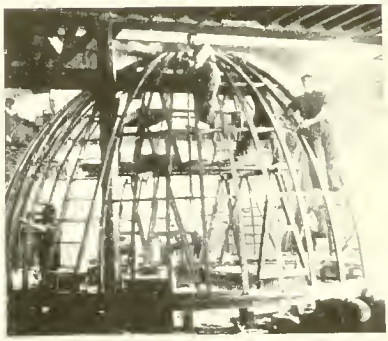
Picture No. 49
View in foundry of Jno. Williams, Inc.
Showing finished moulds

Picture No. 50
View in foundry of Jno. Williams, Inc.
Showing "tub-moulder" at work.

Picture No. 51
View in "Chasing Department" in
Jno. Williams, Inc., Bronze Foundry

Picture No. 52
View in "Chasing Department"
Showing Filers at work.

Picture No. 53
View in "Fitting Department"
Jno. Williams, Inc.



Picture No. 54
"Fitters" at work on Bronze Dome
for Armour Mausoleum.

Picture No. 55
Armour Mausoleum.
Renwick, Aspinwall & Owen, Architects.
Showing cast bronze dome
made by Jno. Williams, Inc.

Picture No. 56

View in foundry of Jno. Williams, Inc.

Showing method of joining bronze
by "Brazing"

Picture No. 57

View in foundry of Jno. Williams, Inc.

Showing "bronzer" at work producing colors on
bronze by the application of chemicals
and heat.

The bronze casting of one-half of the grille is shown in Picture 47 at the right. The impression for the other half can be seen in the mould.

Picture No. 48.

View in Foundry of Jno. Williams, Inc. "Men at Work on Plain Moulds."

Picture No. 49.

View in Foundry Showing Finished Moulds.

Small two-piece moulds are shown in Picture No. 49. These moulds are ready to be clamped together and the metal poured therein.

Picture No. 50.

View in Foundry.

The view in the foundry shown in Picture No. 50 shows a man working at a moulding tub. He is called a "tub-moulder." He is tapping the pattern in the sand so that it may be loosened and easily lifted out. It is interesting to observe the distinct divisions in all these trades. A "tub-moulder" might work all his life within a few feet of a "floor-moulder" (a "floor-moulder" makes large moulds on the floor of the foundry) yet neither one could do the work of the other and these men seemingly have no aptitude for learning "statuary moulding" which is the highest branch of foundry work. The statuary moulder is the "king-pin" of moulders and commands the highest wages.

Picture No. 51.

View in the Chasing Department.

In Picture No. 51 are shown men called "chasers" and "filers" who remove any excrescenses or seams which may be on the casts and file away the rough "burr."

The chasers who work on castings from sculptors' models are specially trained, for as the surfaces on bronze casts from sculptors' models are the individual work of the artist, great care must be taken by the chaser not to change line or plane of the cast in the slightest degree.

Picture No. 52.

Another View in "Chasing Department" showing Filers at work.

Picture No. 53.

View in the "Fitting Department."

The men employed in the "Fitting Department" are called "Fitters," because they fit together all separate parts of the work. This requires mechanical ability of a high order. The parts when carefully fitted, are bolted and screwed together and sometimes are joined by fusing. This is called "brazing." A picture of men brazing will follow.

Picture No. 54.

Bronze Dome for Armour Mausoleum. Renwick, Aspinwall and Owen, Architects.

Picture No. 54 shows the great bronze dome for the "Armour" Mausoleum in the course of construction. The workmen are "fitters." They are fitting the bronze bars on which in turn there will be fitted large cast bronze plates of "fish scale" pattern. The total weight of bronze in the dome is 16 tons and the cost $25,000.00.

Picture No. 55.

Armour Mausoleum.

The completed cast bronze dome on the Armour Mausoleum is shown in Picture No. 55. This mausoleum was designed by the architects, Renwick, Aspinwall and Owen.

Pieture No. 56.

Brazing Bronze.

Joining bronze by soldering is ealled "brazing." The bronze parts to be soldered are wired together and small bits of a special bronze alloy are placed on the joint. A bunsen gas flame under air pressure is then directed on the work. (The men in the picture are at this point in the operation). The pieces to be brazed are heated nearly to melting point. The small bits of solder melt first and run into the joint thus fusing the two parts together. Another instant and the entire work would have melted into a shapeless mass.

Ornamental bronze work for the interior of buildings is given a eoating of transparent laequer which preserves the polish and finish for a number of years. Without this proteetive covering, the bronze work would turn dark in a very short time.

Laequer, however, is not used to protect the surfaces of bronze statuary or other bronze work exposed to the weather for there is no laequer which will stand the aetion of the weather.

New bronze statuary for out-of-doors is oxidized with ehemieals so that the glaring appearance of the new metal is subdued, then if kept free from dirt and grime by the application of a soft eloth, dampened with oil, (preferably olive oil) the eolor of the bronze will deepen and grow rich and mellow with time. The bronze statues in our cities, however are usually negleeted and become eovered with a deposit of soot and dirt and often present a very disreputable appearance. It should be the duty of the city authorities to have the monumental bronze sculptures kept in good condition by expert bronzers.

Picture No. 57.

Producing a Color on Bronze by the Application of Acids and Chemicals.

I wish to call your attention to a wonderful property that bronze possesses that no other material or substance possesses so far as I know. I mean the peculiarity of bronze taking on beautiful colors when subjected to the action of chemicals. Now you know the color of gold never changes. Silver will oxidize black but chemicals will not cause permanent colors to appear on silver. If you apply acids or any chemical or even water to iron, there is just one result, a red rust.

But the surface of bronze reacts to chemicals applied in a certain manner as an autumn leaf does to the frost. Skilled workmen called "Bronzers" easily obtain colors which are as beautiful as those seen on the bronze works of art of antiquity. The color on ancient bronzes is called "patina" which means the color or incrustation which age gives to bronze works of art, but the word "patina" is now generally used to describe the color on modern bronze sculptures.

People have said to me that they always thought bronze was the same color as the surface color "all the way through."

This was a very natural mistake, for it is not often that one sees the natural gold color of bronze and it is easily understood why people should suppose that the dark bronze they saw was the same color all the way through. Newly minted pennies show the bright golden color of bronze, but the action of the air and the acid in the sweat of the hands soon oxidizes the pennies to a dark yellowish color. The color on bronze is an oxidization of the surface only. It is a film of color on the surface of the bronze but is also a part of the bronze itself,—like the

color on the surface of a piece of glazed pottery. Now this oxidization on the surface of the bronze does not continue eating into the metal until the metal is entirely consumed, as the rust of iron does, but the surface of the bronze having become colored it goes no deeper and no matter how many years roll by, yes, or centuries, the glowing golden color of the bronze will show if the surface is abraded or scratched. Thus bronze being practically everlasting, is sometimes called "the eternal metal."

I have in the safe in my office a little bronze statuette, or what is called a "figurine," which was found buried with a mummy in Egypt. Egyptologists tell me that this statuette dates back hundreds of years before Christ and that the mummy was that of a royal personage. However what interests me particularly is the fact that the coloring of the bronze is a beautiful green—not uniform but full of beautiful gradations of color. The high points of the modeling in the statuette having been rubbed by handling, the bronze metal is revealed as bright and gleaming as the day when the Egyptian bronze founder poured it into the mould many centuries ago.

Picture No. 58.

Memorial Tablet Cast from Bronze Recovered from the Wreck of the Battleship "Maine."

When the wreck of the battleship "Maine" was raised in Havana harbor it was suggested by Commander R. H. Leigh, that the bronze metal recovered from the wreck be used to cast tablets which would form memorials of the ill-fated battleship.

The idea was carried out by the Navy Department. A design by Charles Keck, Sculptor, was adopted by the Government and Jno. Williams, Inc. Bronze Foundry selected to cast the tablets. Over twelve tons of this

"Maine" metal was sent to the foundry, a quantity sufficient to cast over 2000 of the "Maine" Memorial tablets.

Applications for these tablets should be made to the Secretary of the Navy, at Washington, D. C.

Picture No. 59.

Bronze Fountain Group, "Pan and the Spirit of Music." For Schenley Fountain, Pittsburgh, Pennsylvania. By Victor D. Brenner, Sculptor.

Many of Mr. Brenner's beautiful bas-relief portraits have been cast in bronze by the Jno. Williams, Inc. foundry.

Picture No. 60.

The Famous Bas-relief Portrait of Robert Louis Stevenson. Modeled from Life by Augustus St. Gaudens.

Picture No. 61.

A Bronze Memorial to the "Bandsmen of the Titanic." Erected in New York City. Modeled by Albert Weinert.

Picture No. 62.

Bronze Panel with Bas-relief Portraits of Mr. and Mrs. Isidor Straus who were lost in the "Titanic" Disaster. This Tablet was Modeled by Louis Lentelli.

Picture No. 63.

Bronze "Seal of the City of New York." By Paul Manship, Sculptor.

Picture No. 64.

Stork Fountain by Philip Martiny. Erected on the Estate of H. H. Rogers, Southampton, L. I.

Picture No. 65.

Bronze Memorial Tablet with Portraits of "Wilkes" and "Barre" by Burr C. Miller, Sculptor. Erected in Public Square, Wilkes-Barre, Penna.

Picture No. 66.

Bronze Bas-relief Portrait of "General Naegle" by R. Tait McKenzie, Sculptor.

Picture No. 67.

Bronze Bust, "Warren Easton" by Hermon MacNeil, Sculptor. Erected in New Orleans, Louisiana.

Picture No. 68.

Bronze Memorial Tablet to "Laura M. Starin" by George E. Bissell, Sculptor. Erected in Reformed Church, Fultonville, N. Y.

Picture No. 69.

Bronze Memorial Tablet, "Emma Louis Schmidlapp" by Clement J. Barnhorn, Sculptor. Erected in Cincinnati, Ohio.

Picture No. 70.

Bronze Bas-relief "Robert Louis Stevenson" by Gutzon Borglum, Sculptor. Erected in "Baker" Cottage, Saranac Lake, New York.

Picture No. 71.

Bronze Bas-relief Memorial to Thomas J. Sullivan by John J. Boyle, Sculptor. Erected in Washington, D. C.

Picture No. 72.

Bronze Bust "Winifred Holt" by C. Percival Dietsch, Sculptor.

Picture No. 73.

Bronze Bas-relief, "Cyrus Bussey" by Frank E. Elwell, Sculptor. Erected in Vicksburg National Military Park, Vicksburg, Miss.

Picture No. 74.

Bronze Bust, "Abraham Lincoln" by John Ettl, Sculptor.

Picture No. 75.

Bronze Bas-relief, "Commemorating the Twenty-fifth Anniversary of the Botany Worsted Mills" by Ulric H. Ellerhusen, Sculptor. Erected in Passaic, N. J.

Picture No. 76.

Bronze Fountain, "Boy and Turtle" by Sherry E. Fry, Sculptor.

Picture No. 77.

Bronze Bust, "Henry Clay Work" by Louis Gudebrod, Sculptor.

Picture No. 78.

Bronze Bas-reliefs, Portraits of "Dickens, Longfellow, Hawthorne, Thackeray, Tennyson and Carlyle" by Ralph Goddard, Sculptor.

Picture No. 79.

Bronze Recumbent Lions by Eli Harvey, Sculptor. Erected on the Eaton Mausoleum, Mt. Pleasant Cemetery, Toronto, Canada.

Picture No. 80.

Bronze Figure "Fox" by Anne V. Hyatt, Sculptor.

Picture No. 81.

Bronze Tablets for Kane County Soldiers' and Sailors' Monument, Geneva, Illinois. By Carl A. Heber, Sculptor.

Picture No. 82.

Bronze Bust of "Colonial Soldier" by H. H. Kitson, Sculptor. Erected on Monument, Washington, Iowa.

Picture No. 83.

Bronze Columbarium, by Ernest Wise Keyser, Sculptor. Erected in Baltimore Cemetery, Baltimore, Maryland.

Picture No. 84.

Bronze Group, "Prometheus" by R. Hinton Perry.

Picture No. 85.

Bronze Bas-relief Memorial to James Smithson, Founder of Smithsonian Institution by William Ordway Partridge, Sculptor. Erected in Smithsonian Institution, Washington, D. C.

Picture No. 86.

Colossal Bronze Tigers on Piney Branch Bridge, Washington, D. C. By A. Phimister Proctor, Sculptor. → R. H. CLARK

Picture No. 87.

Bronze Statuette, "Evening" by F. W. Ruckstuhl, Sculptor. Original in Marble Placed in the Metropolitan Museum of Art.

Picture No. 88.

Bronze Figure for Frog Fountain by Janet Scudder, Sculptor.

Picture No. 89.

Bronze Figure "Piping Faun" by Victor Salvatore, Sculptor.

Picture No. 90.

Bronze Bas-relief Memorial to J. Edward Swanstrom by Edmond T. Quinn, Sculptor.

Picture No. 91.

Bronze Bust, "Dr. Henry Frauenthal" by Jules M. Butensky, Sculptor.

Picture No. 92.

Bronze Statue, "Confederate Vidette" by George Julian Zolnay, Sculptor. Erected in Owensboro, Kentucky.

Picture No. 93.

Bronze Doors for Union Theological Seminary, New York City. By J. Massey Rhind, Sculptor.

Picture No. 94.

Bronze Bust "Emily Howard Stowe" by John Lisney Banks, Sculptor.

Picture No. 95.

Bronze Tablets for Witherspoon Monument, Washington, D. C. By William Couper, Sculptor.

Picture No. 96.

Bronze Bas-relief Portrait "Capt. Charles Vernon Gridley." By Max Bachman, Sculptor. Erected on Gridley Monument, Erie, Pennsylvania.

Picture No. 97.

Bronze Statue of Professor Martin B. Anderson. First President of University of Rochester by Guernsey Mitchell, Sculptor. Statue Erected on Campus, University of Rochester, Rochester, N. Y.

Picture No. 98.

Bronze Tablet with Portrait of Christopher Diehl by Mahonri Young, Sculptor. Erected in Salt Lake City, Utah.

Picture No. 99.

Bronze Angel on "Hammer" Monument by Sigurd Neandross, Sculptor. Erected in Evergreen Cemetery, Brooklyn, N. Y.

Picture No. 100.

Bronze Tablet, Seniors Golf Tournament by Isabel M. Kimball, Sculptor. Erected in the Apawamis Club, Rye, N. Y.

Picture No. 101.

Bronze Tankard by Enid Yandell, Sculptor.

Picture No. 102.

Bronze Statuette of Horse "Tracery" Modeled for August Belmont by Jenny von Wildenrath.

Picture No. 103.

Bronze Statue "Primitive Marksman" (Indian Shooting at Soaring Eagle) by Fernando Miranda, Sculptor. This bronze cast is in New York Historical Society.

Picture No. 104.

Bronze Statue "Falling Gladiator" by Dr. William Rimmer. One bronze cast is in Metropolitan Museum of Art and one is in the Boston Museum of Fine Arts.

Picture No. 105.

Bronze Bas-Relief Portraits by Berenice Langton, Sculptor. Erected in Lawrence Memorial Hospital, New London, Conn.

Picture No. 106.

Bronze Portrait Bust of Joseph Pulitzer by F. R. Blaschke, Sculptor. Bronze Cast in Joseph Pulitzer School for Journalism, Columbia University.

Picture No. 107.

Bronze "Bird Bath Fountain" by Caroline Peddle Ball, Sculptor. Erected in Riverside, Illinois.

Picture No. 108.

Bronze Fountain Figure "Duck Baby" by Edith Barretto Parsons, Sculptor. Erected in Lake Forest, Illinois.

Picture No. 109.

Bronze Statuette "Off-shore Wind" by Alice Morgan Wright, Sculptor.

Picture No. 110.

Bronze Group "Belgian Horses" by Katharine Underhill, Sculptor.

Picture No. 111.

Bronze Bas-Relief Portraits of Mr. and Mrs. H. C. Kelsey by Harriet Frishmuth, Sculptor.

Picture No. 112.

Bronze Statuette "Amazon" by Arthur Lee, Sculptor.

Picture No. 113.

Bronze Doors for Mortuary Chapel by Ulysses A. Ricci, Sculptor.

Picture No. 114.

Bronze Portrait Statuette by Karl H. Gruppe, Sculptor.

Picture No. 115.

Bas-Relief Tablet With Portrait of Andrew Carnegie by Ora Coltman, Sculptor.

Picture No. 116.

Bronze Statuette, "Rocky Mountain Goat" by George D. Pratt, Sculptor.

Picture No. 117.

Bronze Statuette, "Grizzly Bear" by Charles R. Knight, Sculptor.

Picture No. 118.

Bronze Statuette of Dog by L. C. Mayer, Sculptor.

Picture No. 119.

Bronze Portrait Medallion by Helen Sahler, Sculptor.

Picture No. 120.

Bronze Statuette by Elsa Eimer, Sculptor.

Picture No. 121.

Bas-Relief Panel "Power" by John Weichsel, Sculptor.

Picture No. 122.

Bronze Statuette, "Indian in Canoe" by John Francis Brines, Sculptor.

Picture No. 123.

Bronze Bas-Relief Tablet by J. E. Roine, Sculptor.

Picture No. 124.

Bronze Portrait Bust "Conradin Kreutzer" by R. P. Golde, Sculptor.

Picture No. 125.

Bronze Portrait Medallion by J. Scott Hartley, Sculptor.

Picture No. 126.

Bronze Bas-Relief Portrait of Boy by Richard H. Recchia, Sculptor.

Picture No. 127.

Bronze Statuette "Satyr" by F. Harriman Wright, Sculptor.

Picture No. 128.

Bronze Bas-Relief Tablets by Harry Lewis Raul, Sculptor. Erected on Chester County Soldiers' Monument, West Chester, Pa.

Years ago all the workmen in the Jno. Williams, Inc. bronze foundry were foreigners. But the American-born sons in following the trade of the fathers combined a hereditary inclination for the work with the American spirit of progressiveness and they developed into very clever workmen. The Williams foundry has taken many New York boys as apprentices and trained them to become first-class foundrymen, artisans and draughtsmen.

The last picture in the present series is No. 128 and I will finish by inviting all who are interested in the bronze founders' ancient craft to visit the foundry at any time to see the pouring of the molten metal and the various activities of the metal-worker in a modern bronze foundry.

In conclusion I venture to hope that I have given in this lecture some instructive and perhaps interesting information and that because of these words of mine the beauty of bronze work will be more appreciated than heretofore and the high degree of craftsmanship necessary in its production more fully understood.

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